



ORIGINAL ARTICLE

Correlation of Serum Magnesium Level and Blood Glucose status among Type 2 Diabetic Patients

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Abstract

Background: Serum magnesium level is an important electrolytes for the maintenance of haemodynamic of the body. **Objective:** The purpose of the present study was to correlate the serum magnesium level and blood sugar status. **Methodology:** This cross sectional study was carried out in the Department of Medicine at Shaheed Suhrawardy Medical College Hospital, Dhaka, Bangladesh from July 2012 to December 2012. All the type 2 diabetic patients admitted in the Department of Medicine in-patient department of ShSMCH who were 18 years and above age with both sexes were included as study population and were designated as group A and non-diabetic patients were included as group B. Blood samples were drawn after an overnight fast for the measurement of fasting blood sugar and serum magnesium. **Result:** In this present study a total number of 60 patients were enrolled for this study after fulfilling the inclusion and exclusion criteria of which 30 patients were in group A and the rest 30 patients were in group B. The correlation coefficient of FBS and HbA1C with Serum Magnesium level was recorded. The FBS and serum magnesium was negatively correlated to each other significantly which was -0.534. The HbA1C and serum magnesium was negatively correlated to each other significantly which was -0.556. **Conclusion:** In conclusion the blood sugar level is inversely correlate with the serum magnesium level in type 2 diabetic patients. [*Journal of Current and Advance Medical Research, July 2021;8(2):106-109*]

Keywords: Correlation; serum magnesium level; blood glucose status; type 2 diabetic patients

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Introduction

In patients with type 2 diabetes, oral Mg supplementation during a 16-wk period was suggested to improve insulin sensitivity and metabolic control¹. The mechanisms whereby hypomagnesaemia may induce or worsen existing diabetes are not well understood. Nonetheless, it has been suggested that hypomagnesaemia may induce altered cellular glucose transport, reduced pancreatic insulin secretion, defective post-receptor insulin signaling, and/or altered insulin–insulin receptor interactions². Not all studies, however, observed a correlation between glycemic control and serum Mg levels³. Cross-sectional evidence has shown that magnesium intake correlates significantly with features of the metabolic syndrome or insulin resistance syndrome, including adiposity, hyperinsulinemia, insulin resistance, hypertriglyceridemia, and low HDL cholesterol and hypertension⁴. The metabolic syndrome which is defined as a cluster of metabolic abnormalities including obesity, hyperglycemia, hypertension, and dyslipidemia, is now reaching epidemic proportions worldwide and may reflect a common underlying pathophysiology related to insulin resistance. Along the years it has been observed, in world-wide level a reduction of micronutrients ingestion among the populations, due to changes on feeding habits³.

Magnesium (Mg) is one of the most abundant intracellular ions with an essential role in fundamental biological reactions, whose deficiency provokes biochemical and symptomatic alterations in the human organism⁵. Diabetes mellitus (DM) is probably the most associated disease to Mg depletion in intra and extra cellular compartments⁶. Hypomagnesemia has been related as a cause of insulin resistance, also being a consequence of hyperglycemia, and when it is chronic leads to the installation of macro and microvascular complications of diabetes, worsening the deficiency of Mg⁷. The mechanism involving the DM and hypomagnesemia was still unclear, although some metabolic studies demonstrate that Mg supplementation has a beneficial effect in the action of insulin and in the glucose metabolism. The purpose of the present study was to correlate the serum magnesium level and blood sugar status.

Methodology

This comparative cross-sectional study was carried out in the Department of Medicine, Shaheed Suhrawardy Medical College Hospital, Dhaka,

Bangladesh from July 2012 to December 2012 for a period of six (06) months. All the type 2 diabetic patients admitted in the Department of Medicine in-patient department of ShSMCH who were 18 years and above age with both sexes were included as study population and were designated as group A; however, non-diabetic patients in 18 years and above age with both sexes were included as group B. The selected study population were recruited after fulfilling the inclusion and exclusion criteria. Blood samples were drawn after an overnight fast for the measurement of fasting blood sugar, HbA1C and serum magnesium. Data were collected by face to face interview by the researcher himself and were recorded in a predesigned structured questionnaire. Prior to the commencement of the study written consent were taken from the every study participants. After enrolment data on clinical history, clinical features, socio-economic characteristics were collected from all the study participants. Blood sample were collected from every patient and the samples were sent to the department of Biochemistry of National Institute of Cardiovascular Diseases (NICVD), Dhaka for the measurement of serum magnesium, HbA1c, fasting blood glucose, 2 hours after breakfast. This will be performed in Biochemical Auto analyser Machine (Siemens, Germany). Computer based statistical analysis were carried out with appropriate techniques and systems. All data were recorded systematically in preformed data collection form (questionnaire) and quantitative data were expressed as mean and standard deviation and qualitative data were expressed as frequency distribution and percentage. Statistical analysis was performed by using window based computer software devised with Statistical Packages for Social Sciences (SPSS 22.0) (SPSS Inc, Chicago, IL, USA). 95% confidence limit was taken. Probability value <0.05 was considered as level of significance. The association between qualitative variables was measured by Chi-Square test. Student's t test had been performed to see the association between quantitative variables. The summarized data was interpreted accordingly and was then presented in the form of tables.

Result

A total number of 60 patients were enrolled for this study after fulfilling the inclusion and exclusion criteria of which 30 patients were in group A and the rest 30 patients were in group B. Table 1 shows the distribution of study population according to age group. In less than 45 year age group majority were in control group than case group which was 10(52.6%) and 9(47.4%) patients respectively. In

the age group of 45 to 55 year majority were in case group than control group which was 8(53.3%) and 7(46.7%) patients respectively. In the age group of 55 to 65 year majority were in control group than case group which was 8(53.3%) and 7(46.7%) patients respectively. In more than 65 year age group majority were in case group than in control group which was 6(54.5%) and 5(45.5%) respectively.

Table 1: Distribution of Study Population according to Age group (n=60)

Age Group	Group		P value
	Case	Control	
Less Than 45	9(47.4%)	10(52.6%)	0.964*
45 to 55	8(53.3%)	7(46.7%)	
55 to 65	7(46.7%)	8(53.3%)	
More Than 65	6(54.5%)	5(45.5%)	
Total	30(50.0%)	30(50.0%)	
Mean±SD	54.7±10.89	53.3±12.94	0.652**

*Pearson Chi-Square test was performed to see the level of significance; **Student t test was performed to see the level of significance.

The correlation coefficient of FBS and HbA1C with serum magnesium level was done. The FBS and serum magnesium were negatively correlated to each other significantly which was -0.534. The HbA1C and serum magnesium was negatively correlated to each other significantly which was -0.556 (Table 2).

Table 2: Correlation coefficient of FBS and HbA1C with Serum Magnesium level

Variables	r value	P value
FBS	-0.534	0.0001
HbA1C	-0.556	0.0001

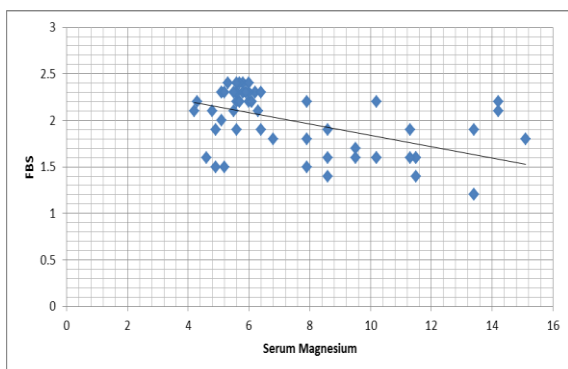


Figure I: Correlation between FBS and serum Magnesium level

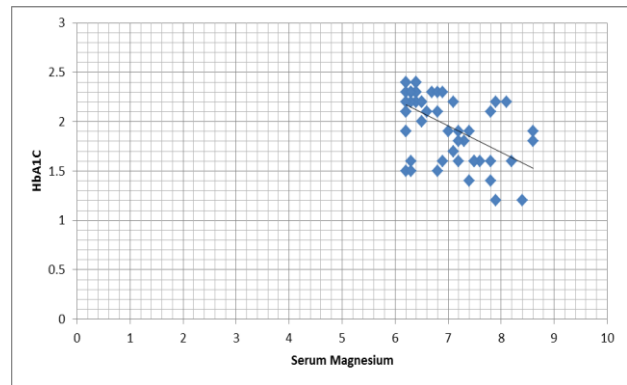


Figure II: Correlation between HbA1C and serum Magnesium level

Discussion

Diabetes mellitus (DM) is characterized by metabolic disorders related to high levels of serum glucose. It is probably the most associated disease to Mg depletion in intra and extra cellular compartments⁸. Hypomagnesemia has been related as a cause of insulin resistance, also being a consequence of hyperglycemia, and when it is chronic leads to the installation of macro and microvascular complications of diabetes, worsening the deficiency of Mg⁹.

In this present study a total number of 60 patients were enrolled for this study after fulfilling the inclusion and exclusion criteria of which 30 patients were in group A and the rest 30 patients were in group B. The distribution of study population according to age group was recorded. In less than 45 year age group majority were in control group than case group which was 10(52.6%) and 9(47.4%) patients respectively. In the age group of 45 to 55 year majority were in case group than control group which was 8(53.3%) and 7(46.7%) patients respectively. In the age group of 55 to 65 year majority were in control group than case group which was 8(53.3%) and 7(46.7%) patients respectively. In more than 65 year age group majority were in case group than in control group which was 6(54.5%) and 5(45.5%) respectively. Middle age patients are more predominant. Type 2 diabetes mellitus is commonly diagnosed in this age group. Similar to the present study result Sales et al¹⁰ have reported that middle age group are commonly affected by type 2 diabetes mellitus.

Previous work suggests several possible mechanisms whereby low serum magnesium levels may lead to the development of type 2 diabetes¹¹. First, as an essential cofactor in reactions involving phosphorylation, magnesium could impair the

insulin signal transduction path way¹². Second, low serum or erythrocyte magnesium level may affect the interaction between insulin and the insulin receptor by decreasing hormone-receptor affinity or by increasing membrane microviscosity¹³. Magnesium can also be a limiting factor in carbohydrate metabolism, since many of the enzymes in this process require magnesium as a cofactor during reactions that utilize phosphorus bonds¹².

The correlation coefficient of FBS and HbA1C with Serum Magnesium level was recorded. The FBS and serum magnesium was negatively correlated to each other significantly which was -0.534. The HbA1C and serum magnesium was negatively correlated to each other significantly which was -0.556. Similar result has been reported by Barbagallo and Dominguez³ and have mentioned that the association between low serum magnesium level was significant; this could be non-causal. Low serum magnesium level simply could be a marker for the effect of other minerals, such as serum calcium and potassium¹¹.

However, no apparent association between calcium or potassium like serum level and dietary intake and the risk for type 2 diabetes was found in the multivariate analyses¹¹. In vivo and in vitro studies have shown that insulin increases intracellular magnesium level in erythrocytes and platelets, suggesting that magnesium transport is an insulin receptor-mediated process¹⁴. In humans, insulin resistance has been implicated to impair the ability of insulin to stimulate magnesium or glucose uptake in diabetic individuals. This line of reasoning suggests that low serum magnesium level simply could be a marker of insulin resistance and hyperinsulinemia¹⁵.

Conclusion

In conclusion the blood sugar level is inversely correlate with the serum magnesium level in type 2 diabetic patients. Moreover, the fasting blood sugar level is moderately correlated with the serum magnesium level. Again the HbA1C level is also correlated moderately with the serum magnesium level. Therefore, the serum magnesium level is an important considering the blood sugar level.

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